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Brief Report

Frequent Sexual Activity Predicts Specific Cognitive Abilities in Older Adults

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Abstract

Objectives: This study replicates and extends the findings of previous research (Wright, H., & Jenks, R. A. (2016). Sex on the brain! Associations between sexual activity and cognitive function in older age. *Age and Ageing*, **45**, 313–317. doi:10.1093/ageing/afv197) which found a significant association between sexual activity (SA) and cognitive function in older adults. Specifically, this study aimed to generalize these findings to a range of cognitive domains, and to assess whether increasing SA frequency is associated with increasing scores on a variety of cognitive tasks.
Methods: Seventy-three participants aged 50–83 years took part in the study (38.4% male, 61.6% female). Participants completed the Addenbrooke's Cognitive Examination-III (ACE-III) cognitive assessment and a questionnaire on SA frequency (never, monthly, or weekly), and general health and lifestyle.
Results: Weekly SA was a significant predictor of total ACE-III, fluency, and visuospatial scores in regression models, including age, gender, education, and cardiovascular health.
Discussion: Greater frequency of SA was associated with better overall ACE-III scores and scores on subtests of verbal fluency and visuospatial ability. Both of these tasks involve working memory and executive function, and links between sexual behavior, memory, and dopamine are discussed. The findings have implications for the maintenance of intimate relationships in later life.

Keywords: Addenbrooke's cognitive examination III—Cognition—Intimate relationships—Dopamine

Increased engagement in mental, social, and physical activity is linked to a lower rate of cognitive decline in older adults (Marioni, van den Hout, Valenzuela, Brayne, & Matthews, 2012; Valenzuela & Sachdev, 2006), with different activities benefitting different cognitive domains (Wang et al., 2013). Research also shows a significant association between sexual activity (SA) and cognitive function in later life (Wright & Jenks, 2016). In terms of the impact on cognition, it is not yet clear whether SA functions as social engagement, or physical activity, or both (alongside emotional, psychological, and biological elements). However, given the complexity of SA and the potential for transcending mental, physical, and social functions, it is possible that increasing frequency of SA (like other activities; Wang et al., 2013) may correspond to better cognition.

Wright and Jenks (2016) reported broad cognitive measures (i.e., word recall and number sequencing) from the English Longitudinal Study of Ageing (ELSA; Steptoe, Breeze, Banks, & Nazroo, 2013), categorized under the umbrella terms of "memory" and "executive function". Though word recall and number sequencing are distinct tasks, they may be underpinned by the same cognitive process(es), that is, working memory (Ackerman, Beier, & Boyle, 2005), as complex cognitive tasks often rely on a wide variety of underlying cognitive processes (Salthouse, 2011). Therefore, we cannot tell from the previous study (Wright & Jenks, 2016) whether SA is linked to global cognition or to specific cognitive domains.

The current study explores whether higher SA frequency is associated with better scores on the Addenbrooke's Cognitive Examination III ([ACE-III]; Hsieh, Schubert, Hoon, Mioshi, & Hodges, 2013). The ACE-III is a validated measure of cognitive function which provides brief measures of five cognitive domains: attention, memory, fluency, language, and visuospatial abilities.

Methods

Participants

Seventy-three participants (28 males, 45 females) aged 50–83 years (M = 61.6; SD = 7.8) were recruited through opportunity sampling via response to adverts disseminated by local community networks. The advert specified that participants should be over the age of 50 years, with no history of dementia, memory impairment, or brain injury. The advertisement stated that the study would involve questions around sexual activities, but that those who were not partnered or not sexually active were equally eligible to take part. Participants were paid a small fee for their time, and the study was approved by the University Research Ethics Committee.

Materials

The ACE-III (Hsieh et al., 2013) was administered according to the standardized guidelines. In addition, participants were asked to fill in a health and lifestyle questionnaire which we devised based on key questions and covariates of interest (see Design section).

Procedure

All participants read a Participant Information Sheet and signed a written informed consent form prior to testing. Testing sessions included administration of the ACE-III and the health and lifestyle questionnaire, in a counterbalanced order. All participants were fully debriefed after testing.

Design

Predictor variables

The main variable of interest was frequency of SA over the past 12 months. This was selfreported by participants from multiple choice options of "never", "monthly", or "weekly". In line with previous studies (Wright & Jenks, 2016) and ELSA Wave 6 (Lee, Nazroo, O'Connor, Blake, & Pendleton, 2016), SA was defined as engagement in sexual intercourse, masturbation, or petting/fondling.

We included age in years, years in education, gender, and cardiovascular health in the multiple regression models. Age and education are key variables known to influence cognitive function (Salthouse, 1996) and gender was included as a standard demographic variable. Cardiovascular health was included as a key physical health variable associated with both cognition and sexual behavior (Desjardins-Crépeau et al., 2014; Levine et al., 2012). Participants indicated if they had any current or previous heart problems (e.g., angina, myocardial infarction, arrhythmia, and coronary heart disease) with a "yes" or "no" response on the questionnaire. Depression, loneliness, and quality of life were measured to assess social wellbeing, using the CES-D (Radloff, 1977; Steffick, 2000), UCLA 3-item loneliness scale (Hughes, Waite, Hawkley, & Cacioppo, 2004), and CASP-19 (Hyde, Wiggins, Higgs, & Blane, 2003), respectively.

Dependent variables

The dependent variables were scores derived from the ACE-III: Total ACE-III score (max. 100), and sub-scores on tests of cognitive domains; attention (max. 18), memory (max. 26), fluency (max. 14), language (max. 26), and visuospatial (max. 16). All scores were calculated as instructed in the user manual. Domain-specific tests included semantic and phonemic verbal fluency (each converted to score bands 1–7 and summed for total score), figure copy, and drawing from memory, numeracy (counting backwards from 100 in sevens), and verbal information learning, recall, and recognition. The tests within the ACE-III have been described in detail elsewhere (Hsieh et al., 2013).

Data analysis

All data were analyzed using IBM SPSS Version 22.0 (IBM Corp., Armonk, NY, USA). Multiple linear regression was used to assess predictors of cognitive function. One-way analysis of variance (ANOVA) and Fisher's exact test were used to assess differences in scores on all cognitive domains and demographic variables between the SA frequency groups.

Results

An overview of the demographics of the sample is presented in Supplementary Table 1, across SA frequency groups.

There was a significant association between SA frequency and gender, where all respondents who reported no SA over the past 12 months (n = 10) were female. Of those reporting monthly SA, just over a third were male (34.6%), whereas reports of weekly SA were more evenly distributed (51.4% male). Across the SA frequency groups, there were no significant differences in age, education, cardiovascular health, marital status, depression, loneliness, or quality of life (see Supplementary Table 1).

To adjust for the effects of age, gender, education, and cardiovascular health, multiple regression was carried out for the total ACE-III scores, as well as for each of the five cognitive domain subscores (Table 1; Supplementary Table 2). The reference category for all was weekly SA, as this was the largest group. No SA ("Never") was a significant predictor of lower total ACE-III scores (M = 89.4, SD = 6.8, β = −0.27, p = .038). Similarly, no SA (M = 11.5, SD = 1.3, β = −0.33, p = .014) and monthly SA (M = 12.1, SD = 2.1, β = −0.26, p = .037) were significant predictors of lower fluency scores. Monthly SA (M = 14.9, SD = 1.3, β = −0.23, p = .051) was a marginally significant predictor of lower visuospatial scores (Table 1). Frequency of SA was not a significant predictor of attention, memory, or language scores (Supplementary Table 2).

Discussion

The current study replicates previous findings (Wright & Jenks, 2016), showing that overall cognitive scores were consistently higher in those who are sexually active compared to those than those who are not. It extends these findings by showing increasing scores on two specific cognitive domains (fluency and visuospatial ability; with the latter approaching significance) with increasing frequency of SA (from never, to monthly, to weekly).

It is noteworthy that in Wright and Jenks (2016), the differences in cognitive scores between sexually active and inactive groups were very small, and so it may be that a greater sample size is required to detect subtle differences in scores for other domains in the current study. It is interesting that gender was not a significant predictor in the current models, especially since the "Never" (i.e., no SA) group contained only females. Research shows that females are less likely to report SA than males, which may represent differential remarriage rates, or females becoming widowed earlier than males (Lindau et al., 2007). This requires consideration in future studies.

Previous research has speculated that mental, physical, and social activities protect cognition through cognitive reserve, reduced inflammatory processes, and reduced risk of cardiovascular and cerebrovascular disease (Wang et al., 2013). Furthermore, we propose a biological relationship between SA frequency and cognition. We found a significant association between SA and fluency and visuospatial ability (although the latter was marginally significant, it

Table 1. Summary of Multiple Regression Statistics for the Predictor Variables for Total ACE-III Scores, Fluency and Visuospatial Domain Sub-Scores

	B	$SE\ B$	β	p	R^2	f^2
Total ACE-III scores						
Constant	100.98	7.91		<.001		
Age (years)	−0.15	0.09	−0.21	.096		
Gender (ref: female)	−0.75	1.43	−0.06	.603		
Education (years)	0.25	0.18	0.17	.168		
Cardiovascular problems (ref: none)	0.19	2.33	0.01	.936		
Frequency of SA (ref: weekly)						
Monthly	−1.86	1.40	−0.16	.189		
Never	−4.39	2.07	−0.27	.038	0.19	0.23
Fluency scores						
Constant	12.73	2.47		<.001		
Age (years)	0.01	0.03	0.02	.857		
Gender (ref: female)	0.08	0.45	0.02	.851		
Education (years)	−0.01	0.06	−0.01	.923		
Cardiovascular problems (ref: none)	−0.77	0.73	−0,12	.295		
Frequency of SA (ref: weekly)						
Monthly	−0.93	0.44	−0.26	.037		
Never	−1.63	0.65	−0.33	.014	0.13	0.15
Visuospatial scores						
Constant	16.41	1.51		<.001		
Age (years)	−0.02	0.02	−0.15	.235		
Gender (ref: female)	−0.39	0.27	−0.17	.161		
Education (years)	0.06	0.03	0.22	.077		
Cardiovascular problems (ref: none)	−0.16	0.45	−0.04	.724		
Frequency of SA (ref: weekly)						
Monthly	−0.53	0.27	−0.23	.051		
Never	−0.39	0.40	−0.12	.323	0.20	0.25

Note: B = unstandardized beta coefficient; SE = standard error; β = standardized beta coefficient; p = significance value; R^2 = variance explained; f^2 = Cohen's effect size.

did have a moderate effect size), which both rely on executive function. The current findings align with the theory of increased SA leading to enhanced dopamine secretion (Melis & Argiolas, 1995), which is linked to improved working memory and executive function in older adults (Chowdhury, Guitart-Masip, Bunzeck, Dolan, & Düzel, 2012; McNab et al., 2009; Baskerville & Douglas, 2008). Verbal fluency is a robust measure of three components of executive function (updating, shifting, and inhibition; Miyake & Friedman, 2012). Therefore, as a complex executive function task, verbal fluency is arguably the most sensitive of the ACE-III tasks to detect subtle differences between SA groups. Future studies should directly incorporate biological measures (e.g., dopamine, oxytocin, and vasopressin; Reyes et al., 2014) to explore the influence of these factors in the complex relationship between SA and cognition.

The current study was limited by the definition of SA (i.e., intercourse, masturbation, and petting), combining different behaviors under one umbrella term, as in ELSA (Lee et al., 2015). While this definition adequately addresses the aims of this paper, we question whether the implications of partnered versus solo activities would be different in terms of cognitive function. This field of study is still relatively young, and we plan to address such details in our subsequent research. Further limitations are posed by the relatively small sample size in this study, which precludes the addition of all other covariates of interest (e.g., physical activity, sociodemographics, further health measures, and marital/cohabiting status) which may have mediating effects on SA frequency and cognition. The addition of these variables, however, did not attenuate the association between SA and cognition in a nationally representative sample (Wright & Jenks, 2016). Furthermore, the coefficients of determination for the current models were in line with previous studies using larger samples (e.g., Wright & Jenks, 2016), giving confidence that the current results are reliable. Finally, as this was a cross-sectional non-experimental study, we cannot infer a causal relationship between SA and cognitive function, but aim to address this question as longitudinal data become available in larger cohort studies.

The current study demonstrates that older men and women who engage in regular SA have better cognitive functioning than those who do not engage in SA, or do so infrequently. Aside from the possible biological underpinnings, this aligns with literature showing neuroprotective properties of increased social, physical, and mental engagement in later life (Marioni et al., 2012; Valenzuela & Sachdev, 2006; Wang et al., 2013). At this time, we can only speculate that continued engagement in regular SA may have a positive influence on cognitive function, but whether SA contributes to cognitive function above and beyond social and physical factors (Wang et al., 2013) is a question for future research. Nevertheless, the findings have important implications for the maintenance of intimate relationships in later life.

Supplementary Material

Supplementary data is available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflicts of Interest

None declared.

References

Ackerman, P. L., Beier, M. E., & Boyle, M. O. (2005). Working memory and intelligence: The same or different constructs? *Psychological Bulletin*, **131**(1), 30–60. doi:10.1037/0033-2909.131.1.30

Baskerville, T. A., & Douglas, A. J. (2008). Interactions between dopamine and oxytocin in the control of sexual behaviour. *Progress in Brain Research*, **170**, 277–290. doi:10.1016/S0079-6123(08)00423-8

Chowdhury, R., Guitart-Masip, M., Bunzeck, N., Dolan, R. J., & Düzel, E. (2012). Dopamine modulates episodic memory persistence in old age. *Journal of Neuroscience*, **32**, 14193–14204. doi:10.1523/JNEUROSCI.1278-12.2012

Desjardins-Crépeau, L., Berryman, N., Vu, T. T., Villalpando, J. M., Kergoat, M. J., Li, K. Z., … Bherer, L. (2014). Physical functioning is associated with processing speed and executive functions in community-dwelling older adults. *Journals of Gerontology. Series B: Psychological Sciences and Social Sciences*, **69**, 837–844. doi:10.1093/geronb/gbu036

Hsieh, S., Schubert, S., Hoon, C., Mioshi, E., & Hodges, J. R. (2013). Validation of the Addenbrooke's cognitive examination III in frontotemporal dementia and Alzheimer's disease. *Dementia and Geriatric Cognitive Disorders*, **36**, 242–250. doi:10.1159/000351671

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging*, **26**, 655–672. doi:10.1177/0164027504268574

Hyde, M., Wiggins, R. D., Higgs, P., & Blane, D. B. (2003). A measure of quality of life in early old age: the theory, development and properties of a needs satisfaction model (CASP-19). *Aging & Mental Health*, **7**, 186–194. doi:10.1080/1360786031000101157

Lee, D. M., Nazroo, J., O'Connor, D. B., Blake, M., & Pendleton, N. (2016). Sexual health and well-being among older men and women in England: Findings from the English Longitudinal

Study of Ageing. *Archives of Sexual Behavior*, **45**, 133–144. doi:10.1007/s10508-014-0465-1

Levine, G. N., Steinke, E. E., Bakaeen, F. G., Bozkurt, B., Cheitlin, M. D., Conti, J. B., … Stewart, W. J.; American Heart Association Council on Clinical Cardiology; Council on Cardiovascular Nursing; Council on Cardiovascular Surgery and Anesthesia; Council on Quality of Care and Outcomes Research. (2012). Sexual activity and cardiovascular disease: A scientific statement from the American Heart Association. *Circulation*, **125**, 1058–1072. doi:10.1161/CIR.0b013e3182447787

Lindau, S. T., Schumm, L. P., Laumann, E. O., Levinson, W., O'Muircheartaigh, C. A., & Waite, L. J. (2007). A study of sexuality and health among older adults in the United States. *New England Journal of Medicine*, **357**, 762–774. doi:10.1056/NEJMoa067423

Marioni, R. E., van den Hout, A., Valenzuela, M. J., Brayne, C., & Matthews, F. E.; MRC Cognitive Function and Ageing Study. (2012). Active cognitive lifestyle associates with cognitive recovery and a reduced risk of cognitive decline. *Journal of Alzheimer's Disease*, **28**, 223–230. doi:10.3233/JAD-2011-110377

McNab, F., Varrone, A., Farde, L., Jucaite, A., Bystritsky, P., Forssberg, H., & Klingberg, T. (2009). Changes in cortical dopamine D1 receptor binding associated with cognitive training. *Science*, **323**, 800–802. doi:10.1126/science.1166102

Melis, M. R., & Argiolas, A. (1995). Dopamine and sexual behavior. *Neuroscience and Biobehavioral Reviews*, **19**, 19–38. doi:10.1016/0149-7634(94)00020-2

Miyake, A., & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science*, **21**, 8–14. doi:10.1177/0963721411429458

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, **1**, 385–401. doi:10.1177/014662167700100306

Reyes, T. L., Galinsky, A. M., Hoffmann, J. N., You, H. M., Ziegler, T. E., & McClintock, M. K. (2014). Social peptides: Measuring urinary oxytocin and vasopressin in a home field study of older adults at risk for dehydration. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, **69** (suppl. 2), S229–S237. doi:10.1093/geronb/gbu104

Salthouse, T. A. (1996). The processing-speed theory of adult age differences in cognition. *Psychological Review*, **103**, 403–428. doi:10.1037/0033-295X.103.3.403

Salthouse, T. A. (2011). What cognitive abilities are involved in trail-making performance? *Intelligence*, **39**, 222–232. doi:10.1016/j.intell.2011.03.001

Steffick, D. E. (2000); HRS Health Working Group. *Documentation of affective functioning measures in the Health and Retirement Study* (Report No.: DR-005). Ann Arbor, MI: Survey Research Centre, University of Michigan.

Steptoe, A., Breeze, E., Banks, J., & Nazroo, J. (2013). Cohort profile: The English longitudinal study of ageing. *International Journal of Epidemiology*, **42**, 1640–1648. doi:10.1093/ije/dys168

Valenzuela, M. J., & Sachdev, P. (2006). Brain reserve and dementia: A systematic review. *Psychological Medicine*, **36**, 441–454. doi:10.1017/S0033291705006264

Wang, H. X., Jin, Y., Hendrie, H. C., Liang, C., Yang, L., Cheng, Y., … Gao, S. (2013). Late life leisure activities and risk of cognitive decline. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences*, **68**, 205–213. doi:10.1093/gerona/gls153

Wright, H., & Jenks, R. A. (2016). Sex on the brain! Associations between sexual activity and cognitive function in older age. *Age and Ageing*, **45**, 313–317. doi:10.1093/ageing/afv197